

## REMARKS

Status of the Claims

Claims 1 – 17 are pending.

Claim Amendments

The claim amendments are made without prejudice, and without disclaimer of the canceled and/or modified subject matter. Indeed, “[t]he language in the ... claims may not capture every nuance of the invention or describe with complete precision the range of its novelty.”<sup>1</sup> Thus, “[t]he scope of [the present claims] is not limited to [their] literal terms but instead embraces all equivalents to the claims described.”<sup>2</sup>

The amendment to claim 1 does not add new matter, because the rewording of the claim to recite a positive process step, such that the claim is directed to a process for the production of primary aluminium, comprising electrolyzing  $\text{Al}_2\text{S}_3$ , is supported throughout the specification for example at page 1, lines 5 – 6, and in the claims as originally presented.

Furthermore, the amendment to claim 1 does not add new matter. The addition of the phrase “wherein the molten chloride salt comprises a  $\text{MgCl}_2$ - $\text{NaCl}$ - $\text{KCl}$  mixture” is supported in the specification on:

page 6, line 26; page 7, last paragraph;

page 9, lines 11 – 21 (describing Figs. 4 and 5);

page 10, lines 10 – 11; and

cathodic density measurements carried out with respect to a mixture of  $\text{MgCl}_2$ - $\text{NaCl}$ - $\text{KCl}$  (see pages 11 to 13 of the specification).

The deletion from claim 1 of the phrase “wherein the bath is essentially free from  $\text{MgCl}_2$ ” does not add new matter. Original claim 1 from the international stage of this application did not require this.

The amendments to claims 6 and 8 do not add new matter. The amendments merely change “the” to “an” in response to a lack of antecedent basis rejection.

---

<sup>1</sup> *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.*, 535 U.S. 722, 731, 122 S.Ct. 1831, 1837 (2002).

<sup>2</sup> *Festo*, 535 U.S. at 731, 122 S.Ct. at 1837.

New claim 15 reciting a concentration of the  $\text{Al}_2\text{S}_3$  is in the range 4 to 10 wt% is supported by the Table on page 11 and by page 12, lines 14 - 15.

New claims 16 and 17 repeat claims 11 and 12 but depend from claim 15.

#### Amendments to the Specification

The amendments to the specification do not add new matter. These amendments are made only to expedite prosecution, without prejudice, and without disclaimer of the canceled subject matter. On page 9, the heading "Brief Description of the Drawings" has been added. On page 8, line 11, the spelling of the word "sulfur" has been corrected.

#### Objections to the Specification

The Office action objected to pages 1 – 13 of the specification, for lacking a "Brief Description of the Drawings" section. The heading has been added.

The Office action objected to page 8, line 11 of the specification because the word, "sulfur," was misspelled as, "sulfer." Applicants corrected the spelling.

Applicants respectfully submit the amendments to the specification address these objections.

#### Claim Rejections

- I. Claims 1 – 14 stand rejected under 35 USC §112, second paragraph, as allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention.

The amendments to claims 1, 6, and 8 moot this rejection.

- II. Claims 1 – 14 stand rejected under 35 USC §112, second paragraph, as allegedly incomplete for omitting essential steps.

The amendment to claim 1 renders this rejection moot. The claim now positively recites an electrolyzing step. Electrolysis is, "A method by which chemical reactions are carried out by passage of electric current through a solution of an electrolyte or through a molten salt." McGraw-Hill Dictionary of Scientific and Technical Terms, 5th edition (1994) (EXHIBIT 1).

- III. Claims 1 – 5, 7 – 9, and 14 stand rejected under 35 USC §102(b) or 35 USC §103(a) over Khazanov et al., “Electrolysis of Fused Aluminum Sulfide,” Legkie Metally (1935), Vol. 4, No. 11, pp. 1 – 14 (hereinafter, “Khazanov”).

Claim 1 as amended requires the molten chloride salt to comprise a  $\text{MgCl}_2$ -NaCl-KCl mixture. Khazanov does not describe using such a mixture, and does not provide an apparent reason to use such a mixture. At page 4, Table 5, and at page 5, Table 6, Khazanov teaches the use of NaCl as chloride metal salt in combination with cryolite in the electrolysis of  $\text{Al}_2\text{S}_3$ . Applicants respectfully submit, therefore, Khazanov neither anticipates nor obviates claim 1. Likewise, Khazanov neither anticipates nor obviates claims 2 – 5, 7 – 9, and 14, which depend from claim 1.

Applicants respectfully note page 7, lines 25 – 26 of the present specification, which states, “[f]rom the prior art it is known to use a bath of molten chloride salts comprising NaCl, KCl, and  $\text{MgCl}_2$ .” Applicants respectfully submit, however, that no apparent reason existed at the time the present invention was made to utilize an additive comprising a fluoride compound in a bath of molten chloride salt that is a  $\text{MgCl}_2$ -NaCl-KCl mixture. As explained in the paragraph bridging pages 4 and 5 of the specification, according to the present invention, it was surprisingly discovered that in a process for the electrolysis of  $\text{Al}_2\text{S}_3$ , using a bath of molten salt, the solubility of  $\text{Al}_2\text{S}_3$  is not the limiting factor in the achievable current density. This discovery was different from what was suggested in the prior art. It was surprisingly discovered that the electrolysis process, at least above a minimum concentration of dissolved  $\text{Al}_2\text{S}_3$ , is not diffusion controlled, but has ohmic limitations. Consequently the allowable current density can be increased by improving the electrical conductivity of the bath.

- IV. Claim 6 stands rejected under 35 USC §103(a) over Khazanov and US 2,939,824 to Greenfield (hereinafter, “Greenfield”).

Claim 6 depends from claim 1, which, as amended, requires the molten chloride salt to be a  $\text{MgCl}_2$ -NaCl-KCl mixture. The combination of references does not describe using such a mixture, and does not provide an apparent reason to use such a mixture. Applicants respectfully submit, therefore, the combination of references does not obviate claim 6.

V. Claim 10 stands rejected under 35 USC §103(a) over Khazanov and US 4,133,727 to Rogers, Jr. (hereinafter, “Rogers”).

Claim 10 depends from claim 1, which, as amended, requires the molten chloride salt to be a  $\text{MgCl}_2$ -NaCl-KCl mixture. The combination of references does not describe using such a mixture, and does not provide an apparent reason to use such a mixture. Applicants respectfully submit, therefore, the combination of references does not obviate claim 10.

VI. Claims 11 and 12 stand rejected under 35 U.S.C §103(a) over Khazanov.

Claims 11 and 12 depend from claim 1, which, as amended, requires the molten chloride salt to be a  $\text{MgCl}_2$ -NaCl-KCl mixture. The combination of references does not describe using such a mixture, and does not provide an apparent reason to use such a mixture. Applicants respectfully submit, therefore, the combination of references does not obviate claims 11 and 12.

VII. Claim 13 stands rejected under 35 U.S.C §103(a) over Khazanov, and US 4,464,234 to Minh et al. (hereinafter, “Minh”).

Claim 13 depends from claim 1, which, as amended, requires the molten chloride salt to be a  $\text{MgCl}_2$ -NaCl-KCl mixture. The combination of references does not describe using such a mixture, and does not provide an apparent reason to use such a mixture. Applicants respectfully submit, therefore, the combination of references does not obviate claim 13.

Fee Authorization

Please charge any shortage in fees due in connection with the filing of this paper, including any shortage in Extension of Time fees, to Deposit Account 14.1437. Please credit any excess fees to such account.

Conclusion

The present application is in condition for allowance, and applicants respectfully request favorable action. In order to facilitate the resolution of any questions, the Examiner is welcome to contact the undersigned by phone.

NOVAK DRUCE + QUIGG, LLP  
1300 Eye St. N.W.  
Suite 1000 West  
Washington, D.C. 20005

Phone: (202) 659-0100  
Fax: (202) 659-0105

Respectfully submitted,  
NOVAK DRUCE + QUIGG, LLP

By: / anthony p venturino/

Anthony P. Venturino  
Registration No. 31,674

Date: Tuesday, February 24, 2009

Attorney Docket No. 8674.031.US0000  
APV/MPB

EXHIBIT 1- excerpt from McGraw-Hill Dictionary of Scientific and Technical Terms,  
5th edition (1994)

# **McGraw-Hill Dictionary of Scientific and Technical Terms**

## **Fifth Edition**

**Sybil P. Parker**  
Editor in Chief

**McGraw-Hill, Inc.**  
New York San Francisco Washington, D.C.  
Auckland Bogotá Caracas Lisbon London Madrid Mexico City Milan  
Montreal New Delhi San Juan Singapore Sydney Tokyo Toronto

**On the cover: Photomicrograph of crystals of vitamin B<sub>12</sub>.  
(Dennis Kunkel, University of Hawaii)**

Included in this Dictionary are definitions which have been published previously in the following works: P. B. Jordain, *Condensed Computer Encyclopedia*, Copyright © 1969 by McGraw-Hill, Inc. All rights reserved. J. Markus, *Electronics and Nucleonics Dictionary*, 4th ed., Copyright © 1960, 1966, 1978 by McGraw-Hill, Inc. All rights reserved. J. Quick, *Artists' and Illustrators' Encyclopedia*, Copyright © 1969 by McGraw-Hill, Inc. All rights reserved. *Blakiston's Gould Medical Dictionary*, 3d ed., Copyright © 1956, 1972 by McGraw-Hill, Inc. All rights reserved. T. Baumeister and L. S. Marks, eds., *Standard Handbook for Mechanical Engineers*, 7th ed., Copyright © 1958, 1967 by McGraw-Hill, Inc. All rights reserved.

In addition, material has been drawn from the following references: R. E. Huschke, *Glossary of Meteorology*, American Meteorological Society, 1959; *U.S. Air Force Glossary of Standardized Terms*, AF Manual 11-1, vol. 1, 1972; *Communications-Electronics Terminology*, AF Manual 11-1, vol. 3, 1970; W. H. Allen, ed., *Dictionary of Technical Terms for Aerospace Use*, 1st ed., National Aeronautics and Space Administration, 1965; J. M. Gilliland, *Solar-Terrestrial Physics: A Glossary of Terms and Abbreviations*, Royal Aircraft Establishment Technical Report 67158, 1967; *Glossary of Air Traffic Control Terms*, Federal Aviation Agency; *A Glossary of Range Terminology*, White Sands Missile Range, New Mexico, National Bureau of Standards, AD 467-424; *A DOD Glossary of Mapping, Charting and Geodetic Terms*, 1st ed., Department of Defense, 1967; P. W. Thrush, comp. and ed., *A Dictionary of Mining, Mineral, and Related Terms*, Bureau of Mines, 1968; *Nuclear Terms: A Glossary*, 2d ed., Atomic Energy Commission; F. Casey, ed., *Compilation of Terms in Information Sciences Technology*, Federal Council for Science and Technology, 1970; *Glossary of Stinfo Terminology*, Office of Aerospace Research, U.S. Air Force, 1963; *Naval Dictionary of Electronic, Technical, and Imperative Terms*, Bureau of Naval Personnel, 1962; *ADP Glossary*, Department of the Navy, NAVSO P-3097.

## **McGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS, Fifth Edition**

Copyright © 1994, 1989, 1984, 1978, 1976, 1974 by McGraw-Hill, Inc. All rights reserved. Printed in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of the publisher.

1 2 3 4 5 6 7 8 9 0    DOW/DOW    9 9 8 7 6 5 4 3

ISBN 0-07-042333-4

### **Library of Congress Cataloging-in-Publication Data**

McGraw-Hill dictionary of scientific and technical terms /

Sybil P. Parker, editor in chief.—5th ed.

p.        cm.

ISBN 0-07-042333-4

1. Science—Dictionaries.    2. Technology—Dictionaries.

I. Parker, Sybil P.

Q123.M34    1993

503—dc20

93-34772

CIP

### **INTERNATIONAL EDITION**

Copyright © 1994. Exclusive rights by McGraw-Hill, Inc. for manufacture and export. This book cannot be re-exported from the country to which it is consigned by McGraw-Hill. The International Edition is not available in North America.

When ordering this title, use ISBN 0-07-113584-7.

[ENG] Any plot, graph, or tracing produced by the action of an electric current on prepared sensitized paper (or other chart material) or by means of an electrically controlled stylus or pen. { i'lek-trə,graf }

**electrographic pencil** [ELECTR] A pencil used to make a conductive mark on paper, for detection by a conductive-mark sensing device. { i'lek-trə,graf'ik'pensəl }

**electrographic recording** [GRAPHICS] Type of electrography in which the electrostatic image is formed by one or more rows of closely spaced parallel wires to which voltages are applied at appropriate instants to form the desired image charge pattern. { i'lek-trə,graf'ik ri'kord-iŋ }

**electrography** [GRAPHICS] The branch of electrostatography in which electrostatic images are formed on an insulating medium without the aid of electromagnetic radiation. { i'lek-trə'grə-rə'fē }

**electrogravimetry** [ANALY CHEM] Electrodeposition analysis in which the quantities of metals deposited may be determined by weighing a suitable electrode before and after deposition. { i'lek-trə'grə'vim-ə-trē }

**electrohydraulic** [ENG] Operated or effected by a combination of electric and hydraulic mechanisms. { i'lek-trə'hī'drəl-ik }

**electrohydraulic effect** [PHYS CHEM] Generation of shock waves and highly reactive species in a liquid as the result of application of very brief but powerful electrical pulses. { i'lek-trə'hī'drəl-ik i'fekt }

**electrohydrodynamic ionization mass spectroscopy** [SPECT] A technique for analysis of nonvolatile molecules in which the nonvolatile material is dissolved in a volatile solvent with a high dielectric constant such as glycerol, and high electric-field gradients at the surface of droplets of the liquid solution induce ion emission. { i'lek-trə'hī'drō-dī'nām'ik, i'zō-nā'zā-shən 'mas spek'trās-kō'pē }

**electroinjection** [BIOL] The use of electric-field impulses to introduce foreign deoxyribonucleic acid directly into intact cells. { i'lek-trō-in'jek-shən }

**electrojet** [GEOPHYS] A stream of intense electric current moving in the upper atmosphere around the equator and in polar regions. { i'lek-trə'jet }

**electrokinetic phenomena** [PHYS CHEM] The phenomena associated with movement of charged particles through a continuous medium or with the movement of a continuous medium over a charged surface. { i'lek-trō-kə'ned-ik fə'nām-ə-nā }

**electrokinetic potential** See zeta potential. { i'lek-trō-kə'ned-ik pə'ten-shəl }

**electrokinetics** [ELECTROMAG] The study of the motion of electric charges, especially of steady currents in electric circuits, and of the motion of electrified particles in electric or magnetic fields. { i'lek-trō-kə'ned-iks }

**electrokinetic transducer** [ELEC] An instrument which converts dynamic physical forces, such as vibration and sound, into corresponding electric signals by measuring the streaming potential generated by passage of a polar fluid through a permeable refractory-ceramic or fritted-glass member between two chambers. { i'lek-trō-kə'ned-ik tranz'dü'ser }

**electrokinetograph** [ENG] An instrument used to measure ocean current velocities based on their electrical effects in the magnetic field of the earth. { i'lek-trō-kə'ned-ə,graf }

**electrokymograph** [MED] An instrument that provides a continuous recording of the movements of an internal organ such as the heart, generally by recording the movements or the changes in density of the shadow of the organ as presented on a fluoroscope. { i'lek-trō'kīmə,graf }

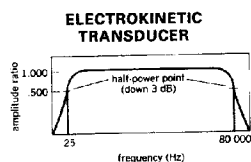
**electroless plating** [MET] Deposition of a metal coating by immersion of a metal or nonmetal in a suitable bath containing a chemical reducing agent. { i'lek-trə-ləs'plād-iŋ }

**electroluminescence** [ELECTR] The emission of light, not due to heating effects alone, resulting from application of an electric field to a material, usually solid. { i'lek-trō,lū'mə'nes-əns }

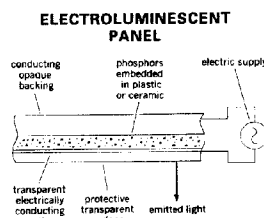
**electroluminescent cell** See electroluminescent panel. { i'lek-trō,lū'mə'nes-ənt'sel }

**electroluminescent display** [ELECTR] A display in which various combinations of electroluminescent segments may be activated by applying voltages to produce any desired numeral or other character. { i'lek-trō,lū'mə'nes-ənt di'splā }

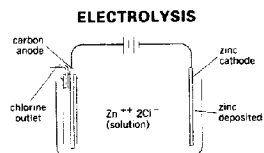
**electroluminescent lamp** See electroluminescent panel. { i'lek-trō,lū'mə'nes-ənt'lamp }



Typical response curve of unit-cell transducer.



Simplified diagram of electroluminescent panel, not drawn to scale.



Electrolysis of zinc chloride solution.

**electroluminescent panel** [ELECTR] A surface-area light source employing the principle of electroluminescence; consists of a suitable phosphor placed between sheet-metal electrodes, one of which is essentially transparent, with an alternating current applied between the electrodes. Also known as electroluminescent cell; electroluminescent lamp; light panel; luminescent cell. { i'lek-trō,lū'mə'nes-ənt'pan-əl }

**electroluminescent phosphor** [MATER] Zinc sulfide powder, with small additions of copper or manganese, which emits light when suspended in an insulator in an intense alternating electric field. Also known as electroluminor. { i'lek-trō,lū'mə'nes-ənt'fās-fər }

**electroluminor** See electroluminescent phosphor. { i'lek-trō'lū'mə,nōr }

**electrolysis** [PHYS CHEM] A method by which chemical reactions are carried out by passage of electric current through a solution of an electrolyte or through a molten salt. { i'lek-trə-lās-sis }

**electrolyte** [PHYS CHEM] A chemical compound which when molten or dissolved in certain solvents, usually water, will conduct an electric current. { i'lek-trə,līt }

**electrolyte acid** See sulfuric acid. { i'lek-trə,līt 'as-əd }

**electrolyte-activated battery** [ELEC] A reserve battery in which an aqueous electrolyte is stored in a separate chamber, and a mechanism, which may be operated from a remote location, drives the electrolyte out of the reservoir and into the cells of the battery for activation. { i'lek-trə,līt ak'tə'vād-əd 'bād-ə-rē }

**electrolytic analysis** [ANALY CHEM] Basic electrochemical technique for quantitative analysis of conducting solutions containing oxidizable or reducible material; measurement is based on the weight of material plated out onto the electrode. { i'lek-trə,lid-ik ə'nal-ə'səs }

**electrolytic arrester** See aluminum-cell arrester. { i'lek-trə,lid-ik ə'res-tər }

**electrolytic brightening** See electropolishing. { i'lek-trə,lid-ik 'brīt-ən-iŋ }

**electrolytic capacitor** [ELEC] A capacitor consisting of two electrodes separated by an electrolyte; a dielectric film, usually a thin layer of gas, is formed on the surface of one electrode. Also known as electrolytic condenser. { i'lek-trə,lid-ik kə'pas-əd-ər }

**electrolytic cell** [PHYS CHEM] A cell consisting of electrodes immersed in an electrolyte solution, for carrying out electrolysis. { i'lek-trə,lid-ik'sel }

**electrolytic cleaning** See electrochemical cleaning. { i'lek-trə,lid-ik 'klēn-iŋ }

**electrolytic condenser** See electrolytic capacitor. { i'lek-trə,lid-ik kən'dens-ər }

**electrolytic conductance** [PHYS CHEM] The transport of electric charges, under electric potential differences, by charged particles (called ions) of atomic or larger size. { i'lek-trə,lid-ik kən'dəkt-əns }

**electrolytic conductivity** [PHYS CHEM] The conductivity of a medium in which the transport of electric charges, under electric potential differences, is by particles of atomic or larger size. { i'lek-trə,lid-ik kən'dəkt'iv-əd-ē }

**electrolytic copper** [MET] Metallic copper produced by electrochemical deposition from a copper ion-containing electrolyte. { i'lek-trə,lid-ik 'kăp-ər }

**electrolytic corrosion** See electrochemical corrosion. { i'lek-trə,lid-ik kə'rō-zhən }

**electrolytic deposition** See electrodeposition. { i'lek-trə,lid-ik dep-ə'zish-ən }

**electrolytic development** [GRAPHICS] Conversion of a latent image on a photosensitive material into a visible image by means of an electric current. { i'lek-trə,lid-ik di'veləp-mənt }

**electrolytic dissociation** [CHEM] The ionization of a compound in a solution. { i'lek-trə,lid-ik di,sō-sē'shən }

**electrolytic etching** [MET] Engraving the surface of a metal by electrolysis. { i'lek-trə,lid-ik 'etʃ-iŋ }

**electrolytic grinding** [MECH ENG] A combined grinding and machining operation in which the abrasive, cathodic grinding wheel is in contact with the anodic workpiece beneath the surface of an electrolyte. Also known as electrochemical grinding. { i'lek-trə,lid-ik 'grīnd-iŋ }

**electrolytic interrupter** [ELEC] An interrupter that consists of two electrodes in an electrolytic solution; bubbles formed in